Final Project Suggestions (COMSE-6998-008 Advanced Data Structures)

Dynamic Optimality

- Dynamic optimality lower bounds (survey: https://arxiv.org/abs/1306.0207)
- A recent machine-learning approach to instance-optimal search and indexing (https://arxiv.org/abs/1712.01208)
- A new approach to proving dynamic optimality for Splay trees (C.Levy, R.Tarjan : A New Path from Splay to Dynamic Optimality, SODA'19)

Predecessor Search

- Exponential trees [Andersen]
- Applications of Fusion Trees [D.Willard: Examining Computational Geometry, Van Emde Boas Trees, and Hashing from the Perspective of the Fusion Tree. SIAM '00]

Persistent and Retroactive Data Structures

- Persistent data structure trees for 2D point location [R.Driscoll, NeilSarnakDaniel D.SleatorRobert E.Tarjan : Making data structures persistent] + David Karger's lecture notes.
- Retroactive DS [E.Demaine, J.Iacono, S.Langerman. Retroactive data strucutres]

Computational geometry

- *Dynamic* Fractional Cascading ([Melhorn and Naher] + http://www.eecs.tufts.edu/~mjones05/frac_casc/)
- Planar point location ("2D predecessor search") [T.Chan, M.Patrascu Transdichotomous Results In Computational Geometry, I: Point Location In Sublogarithmic Time]

Nearest Neighbor Search and LSH

- LSH survey [https://arxiv.org/abs/1806.09823]
- LSH data structure for edit distance [P. Indyk : Approximate Nearest Neighbor under Edit Distance via ProductMetrics]
- LSH data structure for the L_infinity norm [P.Indyk, 1998]
- ANN lower bounds via cell-sampling [https://arxiv.org/abs/1005.0418]

Dictionaries and Hashing

- Tabulation Hashing , Cuckoo Hashing [M.Patrscu , M.Thorup: The Simple Power of Tabulation Hashing]
- Dynamic Dictionaries, Membership and Bloom filters [Bhurman et. Al: Are bitvectors optimal?] [Rajeev R.Raman ,S.Rao : Succinct Dynamic Dictionaries and Trees]

Dynamic Cell-Probe Lower Bounds

- Sharp threshold lower bounds for dynamic data strucutres

[M.Patrscu , M.Thorup: Don't rush into union, take time to find your roots]

- Lopsided Set Disjointness [M.Patrascu : Unifying the landscape of data structure lower bounds].

- Towards higher dynamic cell-probe lower bounds: The Multiphase Conjecture [M.Patrascu]
- The information-transfer method [Demaine-Patrscu]

Succinct Data Strucutres and Information Retrieval

- Compressed Suffix trees and Suffix arrays.
- Compressed Tries and Wavelet Trees.

Graph Data Structures

- Distance Oracles and “Spanners” ([Thorup-Zwick] and related follow-up literature)
- Dynamic undirected reachability.